

**D.) AMENDMENTS TO THE DRAWINGS**

None.

### **E.) REMARKS**

This Response is filed in response to the Office Action dated July 24, 2006.

Upon entry of this Response, claims 13-19 will be pending in the Application.

In the outstanding Office Action, the Examiner made the restriction requirement final; objected to the abstract; objected to claim 20; rejected claims 19 and 20 under 35 U.S.C. 112, second paragraph, as being indefinite; rejected claims 13-18 under 35 U.S.C. § 103(a) as being unpatentable over Luthra et al.(Melt Infiltrated (MI) SiC/SiC Composites for Gas Turbine Applications), hereinafter “Luthra” in view of Park (U.S. Patent No. 3,925,587), hereinafter “Park”, Corman et al. (U.S. Patent No. 5,952,100), hereinafter “Corman”, and Handbook of Composites, 2<sup>nd</sup> Edition, hereinafter “Handbook”; rejected claims 19-20 under 35 U.S.C. § 103(a) as being unpatentable over Luthra in view of Handbook.

#### **Election/Restriction**

The Examiner has made the restriction in the application FINAL. Applicant has canceled claims 1-12 in response to the restriction requirement without prejudice to file a divisional application.

#### **Rejection under 35 U.S.C. 103**

The Examiner rejected claims 13-18 under 35 U.S.C. § 103(a) as being unpatentable over Luthra in view of Park, Corbin and Handbook.

Specifically, the Examiner stated the following:

A. With respect to independent claim 13, Luthra teaches the laying-up, CVI rigidizing, partial, and further densification steps recited in this claim as broadly and conventionally known in the art (pp. 3-4).

This reference fails to teach: (i) the particular orientation of the plies and the fashion in which they are laid-up; (ii) that CVI includes infiltration of BN and SiC; and (iii) that the component is an aircraft engine component.

i. Insofar as Luthra teaches that a “woven” cloth, it is the examiner’s position that the cloth has at least a first warp direction and a second weft direction. Park discloses a woven fabric suitable for use in the formation of a carbon composite having a fewer number of weft tows than warp tows, which imparts tensile strength to the fabric in the longitudinal direction (5:19-64). Consequently, it would have been obvious to one of ordinary skill in the art to modify the process of Luthra so as to utilize such a fabric motivated by the desire to impart said longitudinal tensile strength to the finished composite. Further, *Handbook* teaches that it is known in the art of ceramic composites to arrange/orient plies in the composite so as to achieve a desired, among other things, elastic strength (page 121, for example). Consequently, it would have been obvious to one of ordinary skill in the art to modify the process of Luthra so as to orient the biased plies so as to give a desired tensile strength in a desired direction.

ii. Cerman teaches that it is common in CVI of SiC-SiC composites to infiltrate with both BN and SiC (6:39-47). Consequently, it would have been obvious to one of ordinary skill in the art to modify the process of Luthra, which is silent as to CVI materials, so as to infiltrate with both BN and SiC, which is known in the art as suitable for this purpose.

Applicants respectfully traverse the rejection of claims 13-18 under 35 U.S.C. § 103(a). The following principle of law applies to all Section 103 rejections. MPEP 2143.03 provides “To establish prima facie obviousness of a claimed invention, all claim limitations must be taught or suggested by the prior art. In re Royka, 490 F2d 981, 180 USPQ 580 (CCPA 1974). All words in a claim must be considered in judging the patentability of that claim against the prior art. In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).” [emphasis added] That is, to have any expectation of rejecting the claims over a single reference or a combination of references, each limitation must be taught somewhere in the applied prior art. If limitations are not found in any of the applied prior art, the rejection cannot stand. In this case, the applied prior art references clearly do not arguably teach some limitations of the claims.

Independent claim 13 is directed, *inter alia*, to a method for manufacturing a ceramic matrix composite gas turbine engine component, wherein the steps include laying up the plurality of biased plies in a preselected arrangement to form a component shape and wherein a preselected number of the plurality of biased plies are oriented such that the orientation of the first warp direction of a preselected number of the plurality of biased plies lie about in the direction of maximum tensile stress during normal engine operation (see claim 13, lines 11-15).

The Examiner relies upon Luthra as broadly teaching the steps of laying-up, CVI, rigidizing, and densification. As pointed out by the Examiner, Luthra does not teach the particular orientation of the plies and the fashion in which they are laid-up, the infiltration of BN and SiC and that the component is an aircraft engine component. The Examiner relies upon Park, Corman, and/or Handbook to teach the above-limitations; however, Luthra, Park, Corman and/or Handbook, neither alone nor in combination, teach or suggest the claimed invention.

First, the Examiner's reliance on Luthra is improper because Luthra teaches away from the present invention, see MPEP 2145 (X) (D). Specifically, Luthra discloses the following on page 2, 1<sup>st</sup> paragraph:

"The stress capability of current CMCs is limited, and hence their applications would be limited to stationary components, such as shrouds, combustors, transition pieces, and nozzles or vanes. **Rotating blade/bucket components require much higher stresses than are currently possible with CMCs.**" (emphasis added)

The present invention is directed to gas turbine engine components, including rotating turbine blades (see e.g., specification: paragraph [0035]), wherein the CMCs of Luthra are expressly described as impossible for use as rotating blade/buckets. The inventors of the present invention have discovered a method in which rotating blades/buckets may be fabricated from a ceramic matrix composite, including the orientation of the plies in the direction of maximum tensile strength, which is not taught or suggested in Luthra or any of the additionally cited references. Therefore, as discussed above, the Examiner has improperly cited Luthra, which explicitly teaches away from the present invention.

In addition, several of the features recited by Applicant in independent claim 13 are not taught or suggested by Luthra, Park, Corman and/or Handbook. In particular, the combination of

references, fails to teach the formation of the component shape and the orientation of the plurality of the biased plies in the direction of maximum tensile stress during normal engine operation, as instantly claimed. Although the Examiner indicates that it would have been obvious to modify Luthra with the teachings of Parks, Parks fails to teach any suggestion of formation of the gas turbine component shape, nor the orientation of the plies in the direction of maximum tensile stress. Further Parks is limited to polymer matrix composites, not ceramic matrix composites, as instantly claimed.

Further, Examiner cites Handbook as teaching that it is known in the art of ceramic composites to arrange/orient plies in the component to impart a desired elastic strength. However, the citation to page 321 by the Examiner in Handbook does not teach ceramic matrix composites, but rather is limited to polymer matrix composites. As one of ordinary skill in the art will appreciate, the properties, manufacture and the problems associated with ceramic matrix composites is not the same as the properties, manufacture and the problems associated with polymer matrix composites. For example, polymer matrix composites cannot be utilized at temperatures (specification: paragraph [0004]) or conditions (specification: paragraph [0009]) present in the turbine section of a gas turbine engine and are unsuitable for these gas turbine engine components, wherein the polymer matrix of Park and/or Handbook would volatilize and/or fail. Therefore, the teachings of Handbook and Park do not provide one of ordinary skill in the art teachings that are applicable to ceramic matrix composites and therefore fail to render the instant invention obvious.

The explanation of the rejection seeks to give no weight to the unique character of the area of maximum tensile stress, nor the problems of orienting the plies in the direction of maximum tensile stress. Those in the art faced with the problem of selecting a material for aircraft engine gas turbine components would not look to the teachings of the polymer matrix composites of Park nor Handbook and would not find the claimed steps obvious, since such components, as claimed, are subjected to a wide variety of variable forces and conditions, including various stresses and strains, including those stresses resulting from rotating components, that necessitate identification of areas of maximum stress and the orientation of the plies in those areas. The present invention includes areas of maximum tensile stress, such as the regions 24, shown in FIG. 4 of the present specification and provides orientations in the direction of the maximum tensile stress (specification: paragraph

[0045]). Luthra, Park and Handbook do not teach areas of tensile stress, nor do the references teach the orientation of the plies in the direction of maximum tensile stress. There is no teaching or suggestion in Luthra, Park, and/or Handbook to provide the suggestion of the forming the component shape, nor the orientation of the plies in the direction of maximum tensile stress, as instantly claimed.

Corman is utilized by the Examiner to teach the infiltration of the BN and SiC. However, the Examiner does not provide any evidence in either Corman, nor Luthra establishing that one of ordinary skill in the art would modify Luthra in the manner described by the Examiner. The mere statement that it is known in the art as suitable is insufficient to motivate one of ordinary skill in the art to modify Luthra.

Furthermore, “[t]he mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art suggests the desirability of the combination.” *See* Manual of Patent Examining Procedure, 8<sup>th</sup> Edition (MPEP), Section 2143.01.

The Examiner is reminded that “[i]f the proposed modification or combination of the prior art would change the principle or operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious.” *See* MPEP, Section 2143.01.

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). “All words in a claim must be considered in judging the patentability of that claim against the prior art.” *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

*See* Manual of Patent Examining Procedure, 8<sup>th</sup> Edition (MPEP), Section 2143.03.

Luthra is not properly combinable with Park and/or Handbook. As discussed above, Park and Handbook are directed to polymer matrix composites, wherein Luthra discloses a ceramic matrix composite. In polymer matrix composites the binder is a resinous material (see e.g., Park: col.8, lines 63-68 Handbook: page 321). The polymeric materials have insufficient high temperature properties to be utilized in the gas turbine engine components wherein the material

require temperature capability of 1100-1200 °C, as disclosed in Luthra (see e.g., page 2, 2<sup>nd</sup> paragraph). As would be recognized by one of ordinary skill in the art, the components manufactured utilizing a polymer matrix would volatilize or burn off at temperatures of 1100-1200 °C, rendering the matrix composite useless for its intended purpose as a gas turbine engine component of Luthra. Thus, Applicant respectfully submits that the Examiner has improperly combined the references.

Applicant submits that dependent claims 14-18 are distinguishable from Luthra, Park, Corman and/or Handbook for at least the following reasons. Dependent claims 14-18 are believed to be distinguishable from Luthra, Park, Corman and/or Handbook as depending from what are believed to be allowable independent claim 13 as discussed above.

The Examiner rejected claim 19 under 35 U.S.C. § 103(a) as being unpatentable over Luthra in view of Handbook.

Specifically, the Examiner stated the following:

A. These claims are rejected over these references for the same reasons as detailed above. Specifically, as noted above, orientation of plies to give a desired tensile strength would have been obvious.

B. Further, although none of the cited references specifies these particular components, it is the examiner's position that the process of the cited art is sufficiently robust as to render the manufacture of these other components obvious as well.

Claim 19 is distinguishable from Luthra, and/or Handbook for at least the reasons set forth above with the discussion of the rejection of claims 13-18. Likewise, as discussed above, the Examiner has improperly combined the teachings of Luthra and Handbook. It is further noted that the level of robustness of the teaching of the prior art is insufficient to render the manufacture of the specific component claimed without a teaching or suggestion therein to method of manufacturing the specific components. Therefore, Applicant respectfully requests withdrawal of the rejection of claim 19.

**Rejection under 35 U.S.C. 112**

The Examiner rejected claim 19 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter applicant regards as the invention.

The Examiner stated that in claim 19, the language "the turbine blade shape" lacked proper antecedent basis. In response thereto, Applicant has amended claim 19 in a manner that is believed to overcome the Examiner's rejection to insert antecedent support.

Therefore, in view of the above, Applicant submits that claim 19 is not indefinite and complies with the provisions of 35 U.S.C. 112, second paragraph, and therefore is allowable.

**Objection to the Specification**

The Examiner objected to the specification for various informalities in the abstract. Applicant has amended the abstract in a manner believed to overcome the objection. Therefore, in view of the above it respectfully requested that the Examiner reconsider and withdraw the objection to the abstract.

**CONCLUSION**

In view of the above, Applicant respectfully requests reconsideration of the Application and withdrawal of the outstanding objections and rejections. As a result of the amendments and remarks presented herein, Applicant respectfully submits that claims 13-19 are not anticipated by nor rendered obvious by Luthra, Park, Corman, Handbook or their combination and thus, are in condition for allowance. As the claims are not anticipated by nor rendered obvious in view of the applied art, Applicant requests allowance of claims 13-19 in a timely manner. If the Examiner believes that prosecution of this Application could be expedited by a telephone conference, the Examiner is encouraged to contact the Applicant.



The Commissioner is hereby authorized to charge any additional fees and credit any overpayments to Deposit Account No. 50-1059.

Respectfully submitted,  
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